

CLAIMS

Sub A17

1. A motorized wheel hub assembly having an axis and comprising

a housing having first and second end walls and a side wall extending between said end walls, said walls forming a housing interior surface;

a stator winding in the housing;

a rotor rotatably mounted to the housing end walls so that the rotor can rotate about said axis within the winding;

a first shaft extending from said first wall along said axis;

a second shaft extending from said rotor along said axis away from the first shaft and through said second wall;

a pinion at the end of the second shaft outside the housing;

a plurality of planet gears rotatably mounted to said second end wall outside the housing, said planet gears being in meshing engagement with the pinion;

a third shaft;

means for connecting the third shaft to the second end wall so that the third shaft extends along said axis away from said first and second shafts such that all said shaft are collinear but separate from one another;

a hub enclosing said housing and said planet gears, said hub having first and second end walls rotatably receiving said first and third shafts respectively and a side wall extending between the first and second end walls, said hub side wall being spaced from the housing side wall by a relatively narrow gap;

21 a ring gear formed in the housing interior surface opposite the planet gears, said
22 ring gear being in meshing engagement with the planet gears so that when an electric cur-
23 rent is applied to the stator winding, the rotor rotates relative to the first and third shafts at
24 a selected speed and the hub rotates relative to the first and third shafts at a lesser speed.

1 2. The assembly defined in claim 1 and further including means for sealing the inte-
2 rior of the housing from the interior of the hub.

1 3. The assembly defined in claim 2 and further including means for introducing a
2 thermally conductive liquid into the hub so that when the hub rotates relative to the first
3 and third shafts, said liquid is circulated through said gap so that heat generated within
4 the housing is conducted by the liquid to the hub walls and thence to the outside.

1 4. The assembly defined in claim 1 wherein said third shaft projects through the hub
2 second end wall.

1 5. The assembly defined in claim 1 wherein the hub second end wall covers the third
2 shaft so that the assembly can be cantilever-mounted via the first shaft.

1 6. The assembly defined in claim 1 wherein the rotor, housing side wall and hub side
2 wall are cylindrical.



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1 7. The assembly defined in claim 1 wherein the stator winding is a toroidal, 3 wire, 3
2 phase WYE-connected winding.

1 8. The assembly defined in claim 7 wherein the rotor has a plurality of poles.

1 9. The assembly defined in claim 1 wherein
2 the planet gears are rotatably mounted to axles projecting from the housing
3 second end wall, and
4 the means for connecting include a retainer plate releasably mounted to
5 said axles, said third shaft extending axially from the retainer plate.

1 10. The assembly defined in claim 9 wherein the third shaft projects through the hub
2 second end wall.

1 11. The assembly defined in claim 9 wherein the hub second end wall covers the third
2 shaft so that the assembly can be cantilever-mounted via the first shaft.

1 12. The assembly defined in claim 1 and further including
2 a sprocket, and
3 a one-way clutch connected between the sprocket and the hub second end
4 wall so that the sprocket can rotate about said axis in only one direction relative to the
5 hub.

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1 ~~13~~ The assembly defined in claim 1 and further including
2 a tire rim surrounding the hub side wall;
3 a plurality of spokes having corresponding first and second ends;
4 means for connecting the first ends of the spokes to the hub, and
5 means for connecting the second ends of the spokes to the rim so that the
6 rim is centered on said axis.

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1 ~~14~~ The assembly defined in claim 1 and further including
2 a tire rim surrounding the hub side wall, and
3 means for connecting the tire rim to the hub side wall.

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1 ~~15~~ The assembly defined in claim 15 wherein the means for connecting are releasable
2 so that the rim can be separated from the hub.

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1 ~~16~~ The assembly defined in claim 15 and further including a brake ^{member} ~~disc~~ releasably
2 mounted to one of said hub end walls so as to be centered on said axis.

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1 ~~17~~ The assembly defined in claim 1 and further including a tire engaged around the
2 hub side wall.

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1 ~~18~~ The assembly defined in claim 1 wherein said ring gear is formed in the hub side
2 wall.

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1 ~~19~~ The assembly defined in claim 1 wherein
2 the hub second end wall has a cylindrical skirt which forms an extension
3 of the hub side wall, and
4 said ring gear is formed in said skirt.

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1 ~~20~~ The assembly defined in claim ~~19~~ 20 wherein
2 the hub second end wall is a separate part from the hub side wall, and
3 means for releasably securing the hub second end wall to the hub side
4 wall.

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1 ~~21~~ The assembly defined in claim ~~20~~ 21 wherein each planet gear has a relatively large
2 diameter first section in meshing engagement with the pinion and a smaller diameter sec-
3 ond section collinear to the first section and in meshing engagement with the ring gear so
4 that the assembly has two-stage gear reduction.

22
1 ~~22~~ The assembly defined in claim 1 wherein each planet gear has a relatively large
2 diameter first section in meshing engagement with the pinion and a smaller diameter sec-
3 ond section collinear to the first section and in meshing engagement with the ring gear so
4 that the assembly has two-stage gear reduction.

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- 1 ~~23~~ The assembly defined in claim 1 wherein the hub is less than 5 inches in diameter
2 and the assembly has a gear reduction ratio exceeding 10:1.

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- 1 ~~24~~ The assembly defined in claim 1 wherein the housing second end wall is separable
2 from the housing side wall and the hub first end wall is separable from the hub side wall.

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- 1 ~~25~~ The assembly defined in claim 1 and further including
2 an electrical connector mounted to the first shaft;
3 electrical leads extending from the connector along the first shaft to the
4 interior of the housing, and
5 means for connecting the leads to the stator winding.

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- 1 ~~26~~ The assembly defined in claim 1 and further including
2 first means acting between the rotor and the housing first end wall for bias-
3 ing the rotor toward the third shaft, and
4 second means acting between the means for connecting and the hub sec-
5 ond end wall for biasing the housing toward the first shaft.

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- 1 ~~27~~ A motorized wheel hub assembly comprising

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2 a sealed motor section having first and second end walls and a side wall
3 extending between the end walls, a first shaft extending from the first end wall and a ro-
4 tary second shaft extending from the second end wall coaxial to the first shaft, and
5 a gear reduction section adjacent to the second end wall, said gear reduc-
6 tion section including a pinion at the end of the rotary shaft, a plurality of planet gears
7 rotatably mounted to the second end wall in meshing engagement with the pinion, a third
8 shaft connected to the second end wall, said third shaft being separate from but coaxial to
9 the first and second shafts, a hub having an interior surface closely surrounding the motor
10 section and planet gears and being rotatably coupled to the first and third shafts, and a
11 ring gear formed at the interior surface of the hub in meshing engagement with the planet
12 gears so that when the second shaft rotates at a selected speed, the hub rotates relative to
13 the first and third shafts at a lesser speed.

1 ²⁵~~28~~ The assembly defined in claim ²⁷~~28~~ and further including means for introducing a
2 thermally conductive liquid into the hub so that when the hub rotates, the liquid is circu-
3 lated within the hub so that heat generated within the motor section is conducted by the
4 liquid to the hub and thence to the outside.

1 ²⁹~~28~~ The assembly defined in claim ²⁷~~28~~ wherein the first and third shafts project from
2 the hub.

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1 The assembly defined in claim 28 wherein only the first shaft projects from the
2 hub.

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1 The assembly defined in claim 28 wherein
2 the hub has first and second end walls and a side wall extending between
3 said end walls, and

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1 The assembly defined in claim 32 wherein said ring gear is formed in the hub side
2 wall.

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1 The assembly defined in claim 32 wherein
2 the hub second end wall has a cylindrical skirt which forms an extension
3 of the hub side wall, and
4 said ring gear is formed in said skirt.

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1 The assembly defined in claim 32 wherein
2 the hub second end wall is a separate part from the hub side wall, and
3 means for releasably securing the hub second end wall to the hub side
4 wall.

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1 The assembly defined in claim 35 wherein each planet gear has a relatively large
2 diameter first section in meshing engagement with the pinion and a smaller diameter sec-

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3 and section collinear to the first section and in meshing engagement with the ring gear so
4 that the assembly has two-stage gear reduction.

1 ~~28~~ 27 The assembly defined in claim 28 wherein each planet gear has a relatively large
2 diameter first section in meshing engagement with the pinion and a smaller diameter sec-
3 ond section collinear to the first section and in meshing engagement with the ring gear so
4 that the assembly has two-stage gear reduction.

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